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ABSTRACT

The Conceptual Learning and Development (CID) Model suggests four successive levels of concept learning: (1) concrete--recognizing an object which has been encountered previously; (2) identity--recognizing a known object when it appears in a different spatial, time, or sensory perspective; (3) classificatory--generalizing that two items are alike in some way; and (4) formal--naming and defining the concept, listing its attributes, and judging the presence of such attributes in an object. Once a concept is attained, the individual may use the concept in generalizing to new instances, cognizing supraordinate-subordinate relations, cognizing other relations among concepts, and generalizing to problem-solving situations. Seven subtests were developed to assess the level of attainment and use of the concept, equilateral triangle, from kindergarten through twelfth grade. Criteria for the development of this battery involved several points, in addition to the standard requirements for reliability, objectivity, and usability: it should be appropriate for group administrations to preschool through high school students; and the measures should test a concept that has perceptible representations, generally recognized definitions, and structural taxonomy; is related to the students' curriculum; and is usable in cognizing principles and in problem solving. The battery and administration instructions are appended. (GDC)

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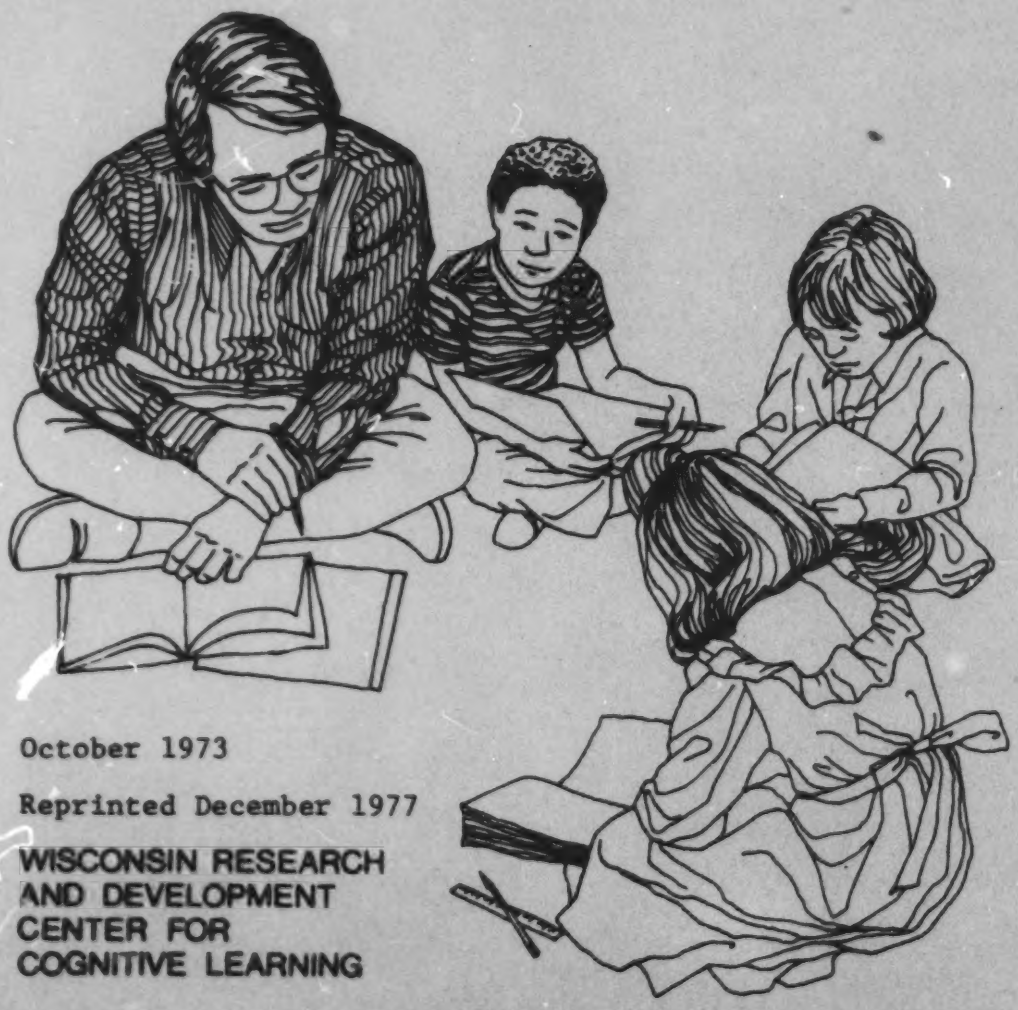
Technical Report No. 430

DEVELOPMENT OF CONCEPTUAL LEARNING AND DEVELOPMENT ASSESSMENT SERIES I: EQUILATERAL TRIANGLE

by Herbert J. Klausmeier, Linda J. Ingison, Thomas S. Sipple, and Conrad G. Katzenmeyer



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Herbert J. Klausmeier, Linda J. Ingison,
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Report from the Project on
Children's Learning and Development

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Wisconsin Research and Development
Center for Cognitive Learning
The University of Wisconsin
Madison, Wisconsin

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- developing and demonstrating improved instructional strategies, processes, and materials for students, teachers, and school administrators
- providing assistance to educators which helps transfer the outcomes of research and development to improved practice in local schools and teacher education institutions

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CENTER FOR COGNITIVE LEARNING

TABLE OF CONTENTS

		Page
I.	Overview of the Conceptual Learning and Development Model	1
II.	Theoretical Framework	3
III.	Procedures and Criteria Used in Developing the Assessment Exercises	13
IV.	Test Battery Instructions	17
V.	Test Battery	39
	References	77

LIST OF FIGURES

Figure		Page
1	Levels of Concept Attainment	6

I

OVERVIEW OF THE CONCEPTUAL LEARNING AND DEVELOPMENT MODEL

This working paper gives an overview of a model of conceptual learning and development (CLD model). The CLD model, in turn, provides the basis for assessing children's level of conceptual development. The assessment of the level of conceptual development requires assessment tools and procedures that may be used with children of about age 4 - 18. The first set of assessment exercises to assess children's level of attainment as well as use of the concept equilateral triangle is presented in this paper after a brief overview of the CLD model.

II

THEORETICAL FRAMEWORK

Model of Conceptual Learning and Development (CLD)

The CLD model is based on laboratory and school experiments. The model was formally reported by Klausmeier (1971) and described more fully by Klausmeier, Ghatala, and Frayer (1972). The CLD model is an analytical, descriptive model. It defines four levels of concept attainment and the possible uses and extensions of attained concepts, specifies the cognitive operations involved in learning concepts at each of the four levels, and postulates internal and external conditions of learning related to the specified levels. The levels of concept mastery and the operations and conditions of learning have been identified through behavioral analyses and empirical research in laboratory and school settings. Guidelines for developing instructional materials have also been formulated based on the model and research in school settings.

A concept is defined as ordered information about the properties of one or more things--objects, events, or processes--that enables any particular thing or class of things to be differentiated from, and also related to, other things or classes of things. The word concept is used by Klausmeier, Ghatala, and Frayer (1972) to designate mental constructs of individuals as well as identifiable public entities that comprise part of the substance of the various disciplines. Thus, the

term concept is used appropriately in two different contexts just as many other English words are.

Concepts as public entities are defined as the organized information corresponding to the meanings of words found in dictionaries, encyclopedias, and other books (Carroll, 1964). Words in a language can be thought of as a series of spoken or written entities. There are meanings for words that can be thought of as a standard of communicative behavior shared by those who speak a language. Finally, there are concepts that are the classes of experiences formed in individuals either independently of language processes or in close dependence on language processes. Putting the three together, Carroll stated: "A 'meaning' of a word is, therefore, a societally standardized concept, and when we say that a word stands for or names a concept it is understood that we are speaking of concepts that are shared among members of a speech community (Carroll, 1964, p. 187)."

When starting a large programmatic research effort dealing with concept learning and instruction, Klausmeier, Davis, Ramsay, Fredrick, and Davies (1965) formulated an idea of concept in terms of defining attributes which they identified as common to many concepts from various disciplines. Klausmeier, Ghatala, and Frayer (1972) carried the definition further by specifying eight attributes of concepts: learnability, usability, validity, generality, power, structure, instance numerousness, and instance perceptibility. Other researchers and subject-matter specialists are also treating concept in terms of defining attributes. For example, Flavell (1970) indicated that a formal definition of concept in terms of its defining attributes is

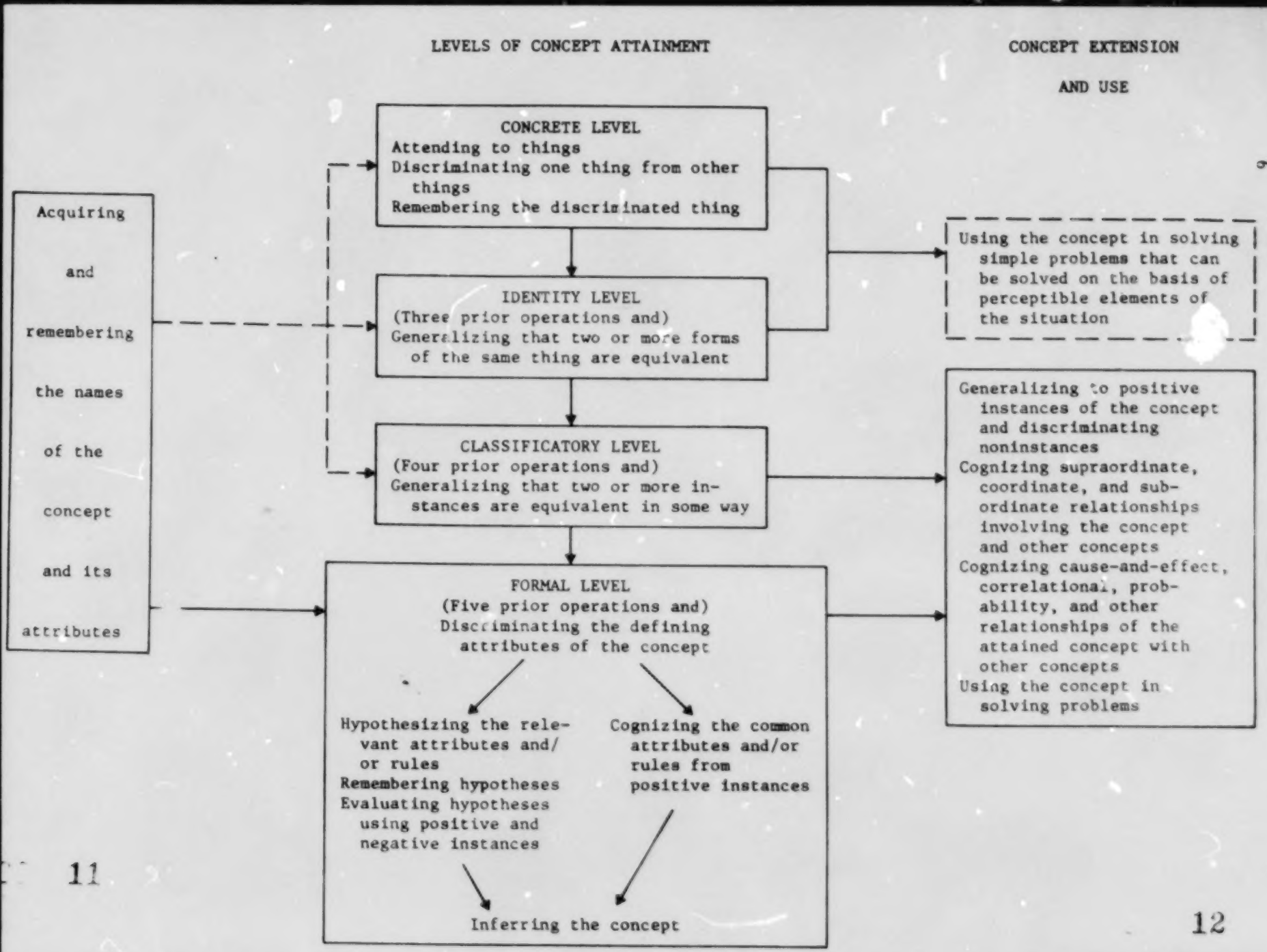
useful in specifying what concepts are and what they are not and also in identifying the great variability among concepts. Markle and Tiemann (1969) and Tennyson and Boutwell (1971) have shown that the external conditions of concept learning can be delineated through research that starts with a systematic analysis of the attributes of the particular concepts used in the research.

The CLD model deals with concepts represented by words that can be defined in terms of attributes. It is pointed out that one cannot find definitions for all words which are stated in terms of defining attributes, even in unabridged dictionaries and technical treatises. Therefore, the researcher and the developer of curriculum materials must ascertain the defining attributes independently or cooperatively with scholars from the various disciplines.

Cognitive Operations and Levels of Concept Attainment

Figure 1 schematically presents the "structure" of the model. It shows the four levels at which individuals may attain the same concept, the operations involved at each level, the use and extension of concepts, and the acquisition of names for concepts and their attributes.

Concept levels. A unique feature of the model is that it specifies four levels of attainment of the same concept, rather than postulating attainment at a final level of mastery the first time the concept is learned. The long-term developmental context of the model is thus provided; the model explains the changes that occur in the level of mastery of concepts attained by the same individual across long time intervals.


LEVELS OF CONCEPT ATTAINMENT
CONCEPT EXTENSION AND USE
Acquiring and remembering the names of the concept and its attributes
CONCRETE LEVEL
Attending to things
Discriminating one thing from other things
Remembering the discriminated thing
IDENTITY LEVEL
(Three prior operations and)
Generalizing that two or more forms of the same thing are equivalent
CLASSIFICATORY LEVEL
(Four prior operations and)
Generalizing that two or more instances are equivalent in some way
FORMAL LEVEL
(Five prior operations and)
Discriminating the defining attributes of the concept
Hypothesizing the relevant attributes and/or rules
Remembering hypotheses
Evaluating hypotheses using positive and negative instances
Cognizing the common attributes and/or rules from positive instances
Inferring the concept
Using the concept in solving simple problems that can be solved on the basis of perceptible elements of the situation
Generalizing to positive instances of the concept and discriminating noninstances
Cognizing supraordinate, coordinate, and subordinate relationships involving the concept and other concepts
Cognizing cause-and-effect, correlational, probability, and other relationships of the attained concept with other concepts
Using the concept in solving problems

Attainment of a concept at the concrete level is inferred when the individual cognizes an object that he has experienced on a prior occasion. At this level, the object is experienced in exactly the same way on the second and later occasions. Attainment of a concept at the identity level is inferred when the individual cognizes an object as the same one previously encountered when observed from a different spatio-temporal perspective or sensed in a different modality. The attainment of a concept at the classificatory level is inferred when the individual treats at least two instances of the same set of things as equivalent. At this level the individual may be unable to name the attributes that are common to the instances. Attainment of a concept at the formal level is inferred when the individual can name the concept, discriminate and name the societally accepted defining attributes and values, and accurately evaluate instances as belonging or not belonging to the set in terms of the presence or absence of the defining attributes.

Successively attaining each higher level of a concept is postulated to be the normative pattern by which many individuals attain many concepts under two conditions: first, the concept is of the kind for which there are actual perceptible instances or representations of instances; and second, the individual has experiences with the instances starting in early childhood. For example, the individual will have successively formed a concept of tree at the concrete, identity, and classificatory levels before he describes and treats tree and various subclasses of plants formally in terms of their defining attributes. It is recognized that some concepts are not attained at all four of

the successive levels because of the nature of the concepts or because the learning experiences of the individual do not permit their acquisition (Klausmeier, Ghatala, & Frayer, 1972).

Cognitive operations. Figure 1 also indicates the operations involved in attaining each level of a concept. This feature of the model provides the context for explaining short-term learning phenomena and also for identifying the changes that occur across time as new operations emerge and make possible attainment at successively higher levels.

In the CLD model the term operations is used much like Guilford (1967) uses the term, rather than the way Piagetians use it. Guilford defines the operations of cognition, memory, productive thinking and evaluation formally and also operationally in terms of test performances. He states that cognition must be related to the products cognized and defines cognition formally as follows:

> Cognition is awareness, immediate discovery or rediscovery, or recognition of information in various forms; comprehension or understanding. . . . The most general term, awareness, emphasizes having active information at the moment or in the present . . . the term, recognition, is applied to knowing the same particular on a second encounter . . . if cognition is practically instantaneous, call it recognition; if it comes with a slight delay, call it "immediate discovery." [Guilford, 1967, pp. 203-204]

According to Guilford, awareness, recognition, and immediate discovery apply generally to two products at the lower levels in his taxonomy, namely, units of information and classes. On the other hand, comprehension, which Guilford used synonymously with understanding, applies to the higher-level products of relations and systems. Thus,

cognition of principles, sequences, patterns, or structures involves comprehension, rather than mere awareness, recognition, or immediate discovery.

The first step in attaining a concept at the concrete level is attending to an object and representing it internally (Woodruff, 1961). Gagné (1970) indicates that as the individual attends to an object he discriminates it from other objects. Woodruff (1961) calls the outcome of these attending and discriminating operations a concrete concept, a mental image of some real object experienced directly by the sense organs. The infant, for example, attends to a large red ball and a white plastic bottle, discriminates each one on a nonanalytic perceptual basis, maintains an internal representation of each, and cognizes each of the objects when experienced later.

Whereas the attainment of a concept at the concrete level involves only the discrimination of an object from other objects, attainment at the identity level involves both discriminating various forms of the same object from other objects and also generalizing the forms as equivalent. The new and critical operation is generalizing. For example, the child attaining the identity level of "dog" generalizes that the family poodle is the same poodle when seen from straight ahead, from the side, and from various angles.

The additional operations required for the attainment of a concept at the classificatory level is generalizing that different instances are equivalent in some way. The individual is still at the classificatory level when he correctly classifies a large number of instances as examples and others as nonexamples, but is unable to

describe the basis for his grouping in terms of the defining attributes of the concept. Henley (cited in Deese, 1967), like many other researchers, reported that individuals can group things without being able to describe the basis of the grouping.

Two sets of operations are involved in the learning of concepts at the formal level, as shown in Figure 1. One set of operations includes discriminating and naming the defining attributes (Fredrick & Klausmeier, 1968; Kalish, 1966; Klausmeier & Meinke, 1968; and Lynch, 1966), hypothesizing the atributes that define the concept (Levine, 1963, 1967), remembering hypotheses (Ghatala, 1972; Williams, 1971), evaluating hypotheses (Bruner, Goodnow, & Austin, 1956), and inferring the concept. These operations go beyond those involved in attaining concepts at the classificatory level and occur when the individual infers the defining attributes by using information from positive and negative instances of the concept. The attribute information may be given to the individual verbally or he may secure it by attending to the positive and negative instances.

The second set of operations given in the right column of Figure 1 includes discriminating and naming the defining attributes, cognizing the common attributes and/or rules from only positive instances, and inferring the concept. According to Tagatz (1967), elementary-school children up to about age 12 carry out these operations. They are not able to utilize information well from negative instances or to hypothesize and evaluate the defining attributes.

Concerning memory, Atkinson and Shiffrin (1968) postulate three memory systems--a long-term store, a short-term store, and a sensory

information register. There is ample evidence that in adults the predominant mode of information storage in both the short- and long-term systems is the verbal-linguistic mode. However, other modes of storage must be possible since adults are able to recognize smells, tastes, and visual stimuli which have not been verbally encoded. Also, a nonlinguistic store is presumed to be essential for preverbal children to learn concrete, identity, and rudimentary class concepts. Bruner (1964) discusses the nonlinguistic features of memory in terms of the enactive and ikonic representation of sensory experiences.

Concept Utilization and Extension

Horizontal transfer is implied by use of the attained concept in recognizing newly encountered examples and nonexamples. Vertical transfer and new learning are presumed to occur as the individual extends his knowledge about an attained concept through using it in understanding various relationships and in solving problems. The individual who has attained a concept at the classificatory or formal level may use it in four ways as shown in Figure 1--in generalizing to new instances, cognizing supraordinate-subordinate relations, cognizing various other relations among concepts, and in generalizing to problem-solving situations. It is not implied that attainment of every concept at the classificatory and formal levels must be followed with all the uses. Little research has been completed regarding any of the uses of attained concepts; however, Ausubel's (1963) constructs of correlative and derivative subsumption are intended to explain how the individual relates concepts to one another. Similarly, Gagné (1970) postulates that having prerequisite concepts is an essential condition of rule learning and problem-solving.

III

PROCEDURES AND CRITERIA USED IN DEVELOPING THE ASSESSMENT EXERCISES

Procedures for Test Development

A subtest was developed to assess each of the four levels of concept attainment and three of the four uses. Because of the difficulty in devising a test to assess the use of a concept in identifying examples and nonexamples which would be distinct from the test assessing attainment of the classificatory level, this use of concepts was not separately assessed. Therefore, seven subtests were developed. The tests required specially constructed materials.

Criteria for Test Development

To develop the tests of concept attainment and utilization, we analyzed the behaviors involved and then constructed materials and developed instructions to assess the behaviors. The test items went through expert review while under development. The entire battery was then tried out on a small scale before it was used in this study.

A few criteria in addition to the usual ones of reliability, objectivity, and usability, were established to guide the development. First, the materials and instructions had to permit assessment of subjects of preschool age through high school. We hypothesized that not all subjects of preschool age would attain a given concept at the concrete level and that not all high school subjects would attain it at the formal level.

Second, the assessment exercises should be administrable to groups of children rather than to individuals. This decision was based on an earlier set of experimental exercises dealing with equilateral triangle which had been administered on an individual basis. Two weaknesses were found with this series of individually-administered exercises. First, certain items at the formal level of attainment and other items connected with uses of the concept in understanding principles and in cognizing subordinate and superordinate relations called for the subject to give the label equilateral triangle or some other label in response to questioning. Although the experimenter had reasonable assurance that a subject who did not give the label actually did not have the label in his spoken vocabulary, there was not complete certainty regarding this. By using multiple-choice items which gave the correct label as one of the choices, this problem was overcome and at the same time the battery could be administered in groups to children who could read reasonably well. A second limitation of the individually-administered items was that judgments were required for the open-ended scoring responses to many items in addition to those based on having the correct label. This weakness was also eliminated by developing a paper and pencil battery.

The third criterion for the selection of the concept was that it had to have perceptible instances or representations thereof. An instance of the concept or a representation of it was needed to test for attainment at the concrete, identity, and classificatory levels.

The fourth selection criterion was that the concept had to be definable by publicly accepted attributes in order to test attainment

at the formal level. In this connection we noted earlier that many concepts are definable in terms of attributes even though this method of definition is often not used in abridged dictionaries.

Fifth, the concept selected for a battery should be relatable to the subject matter which children encounter in school. This is in line with our proposition that directed experience, including instruction in school, is a powerful determininant of the particular concepts attained by individuals and also of their level of attainment and use. Further, since much instruction in school deals with concepts, our model should have applicability to the design of instruction, and the subtests should be usuable, when fully validated, in assessing the level of conceptual development in school-age children.

Sixth, the particular concept had to be part of a taxonomy in order to test its use in cognizing supraordinate-subordinate relationships.

Finally, the concept had to be usuable in cognizing principles and in problem solving. Here, the concept may be usable in solving simple problems without being used first in understanding a principle, or it may be used first in understanding a principle and then in solving more complex problems.

Three of many concepts that meet these criteria are <u>equilateral triangle</u> from the field of mathematics, <u>noun</u> from the field of English, and <u>tree</u> from the field of science. The concept <u>equilateral triangle</u> was selected for the first battery of tests to be developed and administered.

IV

TEST BATTERY INSTRUCTIONS

I-Introduction

The purpose of the Concept Development battery is to assess the level of concept attainment the child has achieved. These instruments are based on the model of conceptual learning and development proposed by H. J. Klausmeier. The battery is intended for use from kindergarten through twelfth grade. However, it may not be necessary or desirable to administer all items or subtests at each grade level.

It is generally assumed that (1) intermediate aged children respond correctly to all items in booklet A; and (2) primary aged children respond incorrectly to certain items in booklets C and D. Therefore, it may be unnecessary to administer part or all of certain booklets to all age levels. It is also necessary to recognize that when younger children are not administered all items, it becomes impossible for them to show full mastery of certain levels. The number of items administered or not administered should be determined in light of the goals of the particular research study.

The battery is administered to intact classroom groups at the higher primary level and above, and to smaller groups of 5 to 7 children at the lower primary level.

The entire battery is read to students regardless of their grade level. Therefore, it is essential that all students be working on the question being read by the administrator. Students mark their answers directly on the test pages so no separate answer sheet is required. Children should

not be allowed to change answers on subtests already taken. All materials needed for testing sessions are listed below:

Materials the student will need:

1. Concept Development Battery
2. Cleared desk top or space to work
3. Pencil

Materials the test administrator will need:

1. Test administrator's manual
2. Copy of the test booklets for demonstration
3. Extra pencils
4. A "Testing: DO NOT DISTURB" sign for the door

Since all directions given orally must be read word for word, it is important that the test administrator study the directions in each manual prior to testing. Familiarity with test directions is enhanced by working with a copy of the test in hand. Directions to the test administrator are in small letters and enclosed in parentheses. Directions to be read to children are in capital letters. In some instances, instructions differ among various forms of the battery being administered; in such cases, the differing instructions will be enclosed in asterisks and labeled appropriately.

II - Directions for Administering the Battery

(Distribute test booklets and pencils to the students. The booklets should be passed out and collected separately for each section of the Battery--IA, IB, IC, ID.)

Directions for Booklet IA (Items 1-6)

(For Kindergarten enter the requested identification information. Direct older students to fill in the name section.) DO NOT TURN THE PAGE UNTIL I TELL YOU TO. ON THE TOP OF THE PAGE FILL IN YOUR NAME, YOUR BIRTHDATE, YOUR SCHOOL'S NAME, YOUR GRADE, AND TODAY'S DATE. TODAY'S DATE IS _____ _____ (Write today's date on the blackboard.) YOU ARE GOING TO BE ASKED QUESTIONS ABOUT THE WAYS IN WHICH THINGS ARE ALIKE, OR THE WAYS IN WHICH THINGS ARE DIFFERENT. THE QUESTIONS ARE NOT ABOUT YOUR SCHOOL WORK, AND YOU WILL NOT RECEIVE A GRADE. YOU MAY FIND SOME OF THE QUESTIONS EASY. OTHERS MAY BE VERY DIFFICULT BECAUSE YOU MAY NOT HAVE LEARNED ABOUT THESE THINGS YET. PLEASE FOLLOW THE DIRECTIONS I GIVE YOU VERY CAREFULLY AND TRY TO DO YOUR BEST ON EACH QUESTION. IN THIS BOOKLET YOU WILL LOOK AT A DRAWING AND THEN FIND ONE EXACTLY LIKE IT ON THE NEXT PAGE. OPEN YOUR BOOKLET TO PAGE 4. (Demonstrate, check to see that each child's booklet is open to page 4.)

LOOK CAREFULLY AT THE DRAWING ON THIS PAGE. (Pause.) NOW TURN TO PAGE 5. THERE IS A BLACK X ON THE DRAWING THAT IS EXACTLY THE SAME AS THE ONE YOU JUST SAW. (Pause.) NOW LET'S DO ANOTHER EXAMPLE, BUT THIS TIME YOU WILL MARK THE X ON THE CORRECT DRAWING YOURSELF WITH YOUR PENCIL.

TURN TO PAGE 7 AND LOOK CAREFULLY AT THE DRAWING. (Demonstrate. Check to see that each child's booklet is open to this page.) NOW TURN TO PAGE 8 AND MARK AN X ON THE DRAWING THAT LOOKS EXACTLY THE SAME. DO NOT LOOK BACK. (Pause.)

****

Intermediate

YOU SHOULD HAVE MARKED AN "X" ON THE THIRD DRAWING FROM THE LEFT. ARE THERE ANY QUESTIONS? (Pause.)

****

Primary

YOU SHOULD HAVE MARKED AN "X" ON THIS DRAWING. (Point.)

****

THE REST OF THE QUESTIONS IN THIS BOOKLET WILL BE LIKE THE ONES YOU JUST DID. YOU WILL LOOK CAREFULLY AT ONE DRAWING, THEN MARK THE DRAWING THAT IS EXACTLY LIKE IT ON THE NEXT PAGE. DO NOT LOOK BACK AFTER YOU HAVE BEEN TOLD TO TURN A PAGE.

****

Intermediate

IF YOU WISH TO CHANGE AN ANSWER, DRAW A CIRCLE AROUND THE "X" THAT YOU THINK IS CORRECT.

****

Primary

WHEN YOU WANT TO CHANGE AN ANSWER, RAISE YOUR HAND AND I WILL HELP YOU CHANGE IT.

****

TURN TO PAGE 9 AND LOOK AT THE DRAWING. (Pause.) NOW TURN TO THE NEXT PAGE AND MARK THE DRAWING THAT LOOKS EXACTLY THE SAME. DO NOT LOOK BACK. (Pause.)

TURN TO PAGE 11 AND LOOK AT THE DRAWING. (Pause.) NOW TURN TO THE NEXT PAGE AND MARK THE DRAWING THAT LOOKS EXACTLY THE SAME. DO NOT LOOK BACK. (Pause.)

TURN TO PAGE 13 AND LOOK AT THE DRAWING. (Pause.) NOW TURN TO THE NEXT PAGE AND MARK THE DRAWING THAT LOOKS EXACTLY THE SAME. (Pause.)

TURN TO PAGE 15 AND LOOK AT THE DRAWING. (Pause.) NOW TURN TO THE NEXT PAGE AND MARK THE DRAWING THAT LOOKS EXACTLY THE SAME. (Pause.)

TURN TO PAGE 17 AND LOOK AT THE DRAWING. (Pause.) NOW TURN TO THE NEXT PAGE AND MARK THE DRAWING THAT LOOKS EXACTLY THE SAME. (Pause.)

TURN TO PAGE 19 AND LOOK AT THE DRAWING. (Pause.) NOW TURN TO THE NEXT PAGE AND MARK THE DRAWING THAT LOOKS EXACTLY THE SAME. (Pause.) NOW WE'RE FINISHED WITH THE FIRST BOOKLET.

TURN TO PAGE 21 AND LOOK AT THE DRAWING. (Pause.) NOW TURN TO THE NEXT PAGE AND MARK THE DRAWING THAT LOOKS EXACTLY THE SAME. (Pause.)

TURN TO PAGE 23 AND LOOK AT THE DRAWING. (Pause.) NOW TURN TO THE NEXT PAGE AND MARK THE DRAWING THAT LOOKS EXACTLY THE SAME. DO NOT LOOK BACK. (Pause.)

TURN TO PAGE 25 AND LOOK AT THE DRAWING. (Pause.) NOW TURN TO THE NEXT PAGE AND MARK THE DRAWING THAT LOOKS THE SAME. (Pause.)

TURN TO PAGE 27 AND LOOK AT THE DRAWING. (Pause.) NOW TURN TO THE NEXT PAGE AND MARK THE DRAWING THAT LOOKS THE SAME. (Pause.)

TURN TO PAGE 29 AND LOOK AT THE DRAWING. (Pause.) NOW TURN TO THE NEXT PAGE AND MARK THE DRAWING THAT LOOKS THE SAME. (Pause.)

TURN TO PAGE 31 AND LOOK AT THE DRAWING. (Pause.) NOW TURN TO THE NEXT PAGE AND MARK THE DRAWING THAT LOOKS THE SAME. (Pause.)

TURN TO PAGE 33 AND LOOK AT THE DRAWING. (Pause.) NOW TURN TO THE NEXT PAGE AND MARK THE DRAWING THAT LOOKS THE SAME. (Pause.)

TURN TO PAGE 35 AND LOOK AT THE DRAWING. (Pause.) NOW TURN TO THE NEXT PAGE AND MARK THE DRAWING THAT LOOKS THE SAME. (Pause.)

TURN TO PAGE 37 AND LOOK AT THE DRAWING. (Pause.) NOW TURN TO THE NEXT PAGE AND MARK THE DRAWING THAT LOOKS THE SAME. (Pause.)

TURN TO PAGE 39 AND LOOK AT THE DRAWING. (Pause.) NOW TURN TO THE NEXT PAGE AND MARK THE DRAWING THAT LOOKS THE SAME. (Pause.) THAT IS THE LAST QUESTION IN THIS BOOKLET. (Collect booklets.)

Directions for Booklet IB
(Primary Instructions)

(For Kindergarten enter the name information. For grade three direct students to fill in their name.)

DO NOT TURN THE PAGE UNTIL I TELL YOU TO. IN THIS BOOKLET ARE QUESTIONS ABOUT THE WAYS IN WHICH THINGS ARE SIMILAR AND DIFFERENT. YOU WILL MARK YOUR ANSWERS BY MARKING AN X ON THE DRAWINGS YOU CHOOSE. WHEN YOU'RE NOT SURE OF AN ANSWER, MARK THE ANSWER YOU THINK IS RIGHT. WHEN YOU WANT TO CHANGE AN ANSWER RAISE YOUR HAND AND I WILL HELP YOU CHANGE IT. OPEN YOUR BOOKLET TO PAGE 1. (Demonstrate.)

ON THIS PAGE IS AN EXAMPLE THAT HAS ALREADY BEEN MARKED. LISTEN CAREFULLY WHILE I READ THE DIRECTIONS AT THE TOP. (Note for Kindergarten: Substitute "over here" for both "on the right" and "on the left." Using a test booklet, demonstrate the stimulus and item response positions referred to by "over here.") IT SAYS, "PUT AN X ON THE DRAWINGS (on the right) THAT HAVE EXACTLY THE SAME SHAPE AS THE ONE (on the left)." (Repeat sentence.) WERE THE "X's" MARKED ON THE CORRECT DRAWING? (Wait for response.) YES, THEY WERE. TURN TO PAGE 2.

NOW WE WILL DO ANOTHER EXAMPLE, BUT THIS TIME YOU WILL MARK THE "X's" ON THE DRAWINGS. WHEN YOU MARK YOUR ANSWERS START AT THE TOP AND LOOK AT EACH DRAWING, ONE AT A TIME. PUT AN X ON THE DRAWINGS ON THE RIGHT THAT HAVE EXACTLY THE SAME SHAPE AS THE ONE ON THE LEFT. YOU CAN LOOK BACK AT THE DRAWING ON THE LEFT IF YOU ARE NOT SURE. (Repeat the directions; pause.) YOU SHOULD HAVE MARKED AN X ON THIS ONE. (Point to middle drawing in top row.) YOU ALSO SHOULD HAVE MARKED AN X ON THIS ONE. (Point to first drawing in bottom row.) AND AN X ON THIS ONE. (Point to last drawing in bottom row.). THESE THREE DRAWINGS ON THE RIGHT HAVE EXACTLY THE SAME SHAPE AS THIS ONE. ARE THERE ANY QUESTIONS ABOUT WHAT TO DO? (If there are questions, go back over the two example problems.) THERE WILL ALWAYS BE MORE THAN ONE DRAWING TO MARK. WHEN YOU ARE NOT SURE OF AN ANSWER, MARK THE DRAWINGS YOU THINK ARE RIGHT. RAISE YOUR HAND WHEN YOU WANT TO CHANGE AN ANSWER. NOW TURN TO PAGE 3.

(Pace children through the test. Wait until all children have completed an item before proceeding to the next item. For each item carefully check to see that each child is on the correct page.)

"PUT AN X ON THE DRAWINGS (ON THE RIGHT) THAT HAVE EXACTLY THE SAME SHAPE AS THE ONE (ON THE LEFT)." (Problem 1.) (Repeat sentence. Pause.) TURN TO PAGE 4.

WHEN YOU MARK YOUR ANSWERS START AT THE TOP AND LOOK AT EACH DRAWING, ONE AT A TIME. LISTEN. "PUT AN X ON THE DRAWINGS (ON THE RIGHT) THAT HAVE EXACTLY THE SAME SHAPE AS THE ONE (ON THE LEFT). . . PUT AN X ON THE DRAWINGS (ON THE RIGHT) THAT HAVE EXACTLY THE SAME SHAPE AS THE ONE (ON THE LEFT)." (Problem 2.) (Pause.) TURN TO PAGE 5.

WHEN YOU MARK YOUR ANSWERS START AT THE TOP AND LOOK AT EACH DRAWING, ONE AT A TIME. LISTEN. "PUT AN X ON THE DRAWINGS (ON THE RIGHT) THAT HAVE EXACTLY THE SAME SHAPE AS THE ONE (ON THE LEFT). . . PUT AN X ON THE DRAWINGS (ON THE RIGHT) THAT HAVE EXACTLY THE SAME SHAPE AS THE ONE (ON THE LEFT)." (Problem 3) (Pause.) TURN TO PAGE 6.

****

PAGE 6 Instructions for Kindergarten

NOW YOU WILL ANSWER QUESTIONS THAT ARE DIFFERENT FROM BEFORE. I AM GOING TO READ THIS QUESTION (Point.) ABOUT THE DRAWINGS AT THE TOP OF THE PAGE. (Point.) I WILL ALSO READ FOUR DIFFERENT ANSWERS TO THE QUESTION. (Point to each answer choice and indicate that a is one answer, b is another answer, etc., through d.) ONLY ONE OF THESE FOUR ANSWERS IS CORRECT. YOU ARE TO MARK AN X ON THE LETTER a, b, c, or d TO SHOW THE ANSWER YOU THINK IS RIGHT. YOU WILL MARK AN X ON ONLY ONE OF THESE LETTERS. WHEN YOU DON'T KNOW THE ANSWER, YOU CAN MARK d, WHICH SAYS "I DON'T KNOW." DO YOU HAVE ANY QUESTIONS ABOUT WHAT TO DO? (Repeat the above procedure if necessary. Read the question and answer choices on page 6 twice. Point to each answer choice as you read it aloud.)

PROBLEM 4: ARE ALL OF THE THREE-SIDED FIGURES ABOVE EQUILATERAL TRIANGLES?

A - YES, ALL OF THEM ARE EQUILATERAL TRIANGLES.

B - NO, SOME OF THEM ARE NOT EQUILATERAL TRIANGLES.

C - NO, NONE OF THEM ARE EQUILATERAL TRIANGLES.

OR

D - I DON'T KNOW.

(Pause.) (Read question and answer choices on page 6 twice.)

****

PAGE 6 Instructions for Grade Three

NOW YOU WILL ANSWER QUESTIONS THAT ARE DIFFERENT FROM BEFORE. I WILL READ THE QUESTION THAT ASKS ABOUT THE DRAWINGS AT THE TOP OF THE PAGE. I WILL ALSO READ THE FOUR DIFFERENT ANSWER CHOICES FOR THE QUESTION--ANSWER CHOICES a, b, c, and d. ONLY ONE OF THESE ANSWERS IS CORRECT. YOU ARE TO MARK X ON THE LETTER OF THE ANSWER CHOICE THAT YOU THINK IS RIGHT. WHEN YOU DON'T KNOW THE ANSWER, YOU CAN MARK d, WHICH SAYS "I DON'T KNOW." YOU MAY READ ALONG SILENTLY AS I READ OUT LOUD. READY?

PROBLEM 4: ARE ALL OF THE THREE-SIDED FIGURES ABOVE EQUILATERAL TRIANGLES?

A - YES, ALL OF THEM ARE EQUILATERAL TRIANGLES.

B - NO, SOME OF THEM ARE NOT EQUILATERAL TRIANGLES.

C - NO, NONE OF THEM ARE EQUILATERAL TRIANGLES.

OR

D - I DON'T KNOW.

(Pause.) (Read the question and answer choices on page 6 twice.)
MARK YOUR ANSWER AND TURN TO PAGE 7.

****

PAGES 7-13 Instructions for Kindergarten and Grade Three

(1) Using your test booklet, read aloud each question and the answer choices twice.

(2) Pace students through the items. Wait until all students have completed an item before proceeding to the next item.

(3) Check to see that all students are on the right page.

(4) For Kindergarten point to each answer choice as you read it aloud.

PROBLEM 5: ARE ALL OF THE EQUILATERAL TRIANGLES ABOVE TRIANGLES?

A - NO, ONLY SOME OF THEM ARE TRIANGLES.

B - NO, NONE OF THEM ARE TRIANGLES.

C - YES, ALL OF THEM ARE TRIANGLES.

OR

D - I DON'T KNOW.

(Pause.) (Read the question and answer choices on page 7 twice.)

MARK YOUR ANSWER AND TURN TO PAGE 8.

PROBLEM 6: IF YOU TOOK ALL THE EQUILATERAL TRIANGLES AND THE RIGHT TRIANGLES ABOVE AND PUT THEM IN A GROUP THERE WOULD BE _____ THERE WERE THREE-SIDED FIGURES.

A - FEWER OF THEM THAN

B - MORE OF THEM THAN

C - THE SAME AMOUNT OF THEM AS

OR

D - I DON'T KNOW.

(Pause.) (Read the question and answer choices on page 8 twice.)

MARK YOUR ANSWER AND TURN TO PAGE 9.

PROBLEM 7: ARE ALL OF THE RED FIGURES ABOVE EQUILATERAL TRIANGLES?

A - NO, SOME OF THEM ARE NOT EQUILATERAL TRIANGLES.

B - YES, ALL OF THEM ARE EQUILATERAL TRIANGLES.

C - NO, NONE OF THEM ARE EQUILATERAL TRIANGLES.

OR

D - I DON'T KNOW.

(Pause.) (Read the question and answer choices on page 9 twice.)

MARK YOUR ANSWER AND TURN TO PAGE 10.

PROBLEM 8: ARE ALL OF THE SMALL FIGURES ABOVE EQUILATERAL TRIANGLES?

A - NO, SOME OF THEM ARE NOT EQUILATERAL TRIANGLES.

B - YES, ALL OF THEM ARE EQUILATERAL TRIANGLES.

C - NO, NONE OF THEM ARE EQUILATERAL TRIANGLES.

OR

D - I DON'T KNOW.

(Pause.) (Read the question and answer choices on page 10 twice)

MARK YOUR ANSWER AND TURN TO PAGE 11.

PROBLEM 9: ARE ALL OF THE TRIANGLES ABOVE POLYGONS?

A - NO, NONE OF THEM ARE POLYGONS.

B - YES, ALL OF THEM ARE POLYGONS.

C - NO, ONLY SOME OF THEM ARE POLYGONS.

OR

D - I DON'T KNOW.

(Pause.) (Read the question and answer choices on page 11 twice.)

MARK YOUR ANSWER AND TURN TO PAGE 12.

PROBLEM 10: ARE ALL OF THE POLYGONS ABOVE TRIANGLES?

A - NO, SOME OF THEM ARE NOT TRIANGLES.

B - YES, ALL OF THEM ARE TRIANGLES.

C - NO, NONE OF THEM ARE TRIANGLES.

OR

D - I DON'T KNOW.

(Pause.) (Read the question and answer choices on page 12 twice.)

MARK YOUR ANSWER AND TURN TO PAGE 13.

PROBLEM 11: IF YOU TOOK ALL OF THE TRIANGLES AND THE RECTANGLES ABOVE AND PUT THEM IN A GROUP THERE WOULD BE _____ THERE WERE POLYGONS.

A - FEWER OF THEM THAN

B - MORE OF THEM THAN

C - THE SAME AMOUNT OF THEM AS

OR

D - I DON'T KNOW

(Pause.) (Read the question and answer choices on page 13 twice.)

MARK YOUR ANSWER AND STOP.

****

PAGE 14 Instructions for Kindergarten and Grade Three

BELOW ARE FOUR DRAWINGS. PUT AN X ON THE ONE THAT IS DIFFERENT FROM THE OTHER THREE . . . PUT AN X ON THE ONE THAT IS DIFFERENT FROM THE OTHER THREE. (Pause.) (Problem 12a) TURN TO PAGE 15.

BELOW ARE FOUR DRAWINGS. PUT AN X ON THE ONE THAT IS DIFFERENT FROM THE OTHER THREE. . . PUT AN X ON THE ONE THAT IS DIFFERENT FROM THE OTHER THREE. (Pause.) (Problem 12b) TURN TO PAGE 16.

BELOW ARE FOUR DRAWINGS. PUT AN X ON THE ONE THAT IS DIFFERENT FROM THE OTHER THREE . . . PUT AN X ON THE ONE THAT IS DIFFERENT FROM THE OTHER THREE. (Pause.) (Problem 12c)

THIS IS THE LAST PROBLEM IN THIS BOOKLET. (Collect answer booklets.)

Directions for Booklet IB
(Intermediate Instructions)

WRITE YOUR NAME IN THE SPACE AT THE TOP OF THE FRONT PAGE. (Pause.) TURN TO PAGE 1.

IN THIS SECTION YOU ARE TO MARK ALL OF THE DRAWINGS ON THE RIGHT THAT ARE LIKE THE DRAWING ON THE LEFT IN SOME WAY. THERE WILL ALWAYS BE MORE THAN ONE DRAWING THAT SHOULD BE MARKED. LOOK AT EXAMPLE "A" BELOW.

PUT AN "X" ON THE DRAWINGS ON THE RIGHT THAT HAVE EXACTLY THE SAME SHAPE AS THE ONE ON THE LEFT.

TWO OF THE DRAWINGS ON THE RIGHT HAVE "X's" ON THEM BECAUSE THEY HAVE EXACTLY THE SAME SHAPE AS THE ONE ON THE LEFT. THEY ARE ALSO ROUND.

BELOW IS ANOTHER EXAMPLE, BUT THIS TIME YOU ARE TO MARK THE "X's" ON THE DRAWINGS.

PUT AN "X" ON THE DRAWINGS ON THE RIGHT THAT HAVE EXACTLY THE SAME SHAPE AS THE ONE ON THE LEFT. YOU CAN LOOK BACK AT THE DRAWING ON THE LEFT IF YOU ARE NOT SURE. (Pause.)

YOU SHOULD HAVE MARKED "X's" ON THE MIDDLE ONE IN THE TOP ROW AND THE FIRST AND LAST ONE IN THE BOTTOM ROW BECAUSE THEY HAVE EXACTLY THE SAME SHAPE AS THE DRAWING ON THE LEFT. ARE THERE ANY QUESTIONS ABOUT WHAT TO DO? (Pause - if there are questions, go back over the two example problems.)

LOOK AT PROBLEM 1 ON PAGE 3. PUT AN "X" ON THE DRAWINGS ON THE RIGHT THAT HAVE EXACTLY THE SAME SHAPE AS THE ONE ON THE LEFT. (Pause.) TURN TO PAGE 4.

PROBLEM 2: PUT AN "X" ON THE DRAWINGS ON THE RIGHT THAT HAVE EXACTLY THE SAME SHAPE AS THE ONE ON THE LEFT. (Pause.) TURN TO PAGE 5.

PROBLEM 3: PUT AN "X" ON THE DRAWINGS ON THE RIGHT THAT HAVE EXACTLY THE SAME SHAPE AS THE ONE ON THE LEFT. (Pause.) TURN TO PAGE 6.

THIS SECTION DEALS WITH THE WAYS THAT A DRAWING CAN BE PUT INTO MORE THAN ONE GROUP. FOR EACH PROBLEM YOU WILL SEE A GROUP OF DRAWINGS AND AN INCOMPLETE STATEMENT ABOUT THE DRAWINGS. YOU ARE TO SELECT THE ANSWER THAT WILL CORRECTLY COMPLETE THE STATEMENT. MARK AN "X" ON THE LETTER THAT IDENTIFIES THE CORRECT ANSWER. FOR SOME OF THE QUESTIONS YOU MAY NOT KNOW THE CORRECT ANSWER. IF NOT, MARK THE LETTER BY "I DON'T KNOW." IF YOU WISH TO CHANGE AN ANSWER, DRAW A CIRCLE AROUND THE "X" THAT YOU THINK IS CORRECT.

(For problems 4 through 12 read aloud each question and the answer choices. Pace the students through the items. Wait until the students have completed an item before proceeding to the next item. Make sure all the students are on the right page.)

QUESTION 4: ARE ALL OF THE THREE-SIDED FIGURES ABOVE EQUILATERAL TRIANGLES?

A - YES, ALL OF THEM ARE EQUILATERAL TRIANGLES.

B - NO, SOME OF THEM ARE NOT EQUILATERAL TRIANGLES.

C - NO, NONE OF THEM ARE EQUILATERAL TRIANGLES.

OR

D - I DON'T KNOW.

(Pause.)

QUESTION 5: ARE ALL OF THE EQUILATERAL TRIANGLES ABOVE TRIANGLES?

A - NO, ONLY SOME OF THEM ARE TRIANGLES.

B - NO, NONE OF THEM ARE TRIANGLES.

C - YES, ALL OF THEM ARE TRIANGLES.

OR

D - I DON'T KNOW.

(Pause.)

QUESTION 6: IF YOU TOOK ALL OF THE EQUILATERAL TRIANGLES AND THE RIGHT TRIANGLES ABOVE AND PUT THEM IN A GROUP THERE WOULD BE _____ THERE WERE THREE-SIDED FIGURES.

A - FEWER OF THEM THAN

B - MORE OF THEM THAN

C - THE SAME AMOUNT OF THEM AS

OR

D - I DON'T KNOW.

(Pause.)

QUESTION 7: ARE ALL OF THE RED FIGURES ABOVE EQUILATERAL TRIANGLES?

A - NO, SOME OF THEM ARE NOT EQUILATERAL TRIANGLES.

B - YES, ALL OF THEM ARE EQUILATERAL TRIANGLES.

C - NO, NONE OF THEM ARE EQUILATERAL TRIANGLES.

OR

D - I DON'T KNOW.

(Pause.) TURN TO PAGE 10.

LOOK AT THESE SIX DRAWINGS AND ANSWER QUESTION 8.

QUESTION 8: ARE ALL OF THE SMALL FIGURES ABOVE EQUILATERAL TRIANGLES?

A - NO, SOME OF THEM ARE NOT EQUILATERAL TRIANGLES.

B - YES, ALL OF THEM ARE EQUILATERAL TRIANGLES.

C - NO, NONE OF THEM ARE EQUILATERAL TRIANGLES.

OR

D - I DON'T KNOW.

(Pause.)

LOOK AT THESE EIGHT DRAWINGS AND ANSWER QUESTIONS 9-11.

QUESTION 9: ARE ALL OF THE TRIANGLES ABOVE POLYGONS?

A - NO, NONE OF THEM ARE POLYGONS.

B - YES, ALL OF THEM ARE POLYGONS.

C - NO, ONLY SOME OF THEM ARE POLYGONS.

OR

D - I DON'T KNOW.

(Pause.)

QUESTION 10: ARE ALL OF THE POLYGONS ABOVE TRIANGLES?

A - NO, SOME OF THEM ARE NOT TRIANGLES.

B - YES, ALL OF THEM ARE TRIANGLES.

C - NO, NONE OF THEM ARE TRIANGLES.

OR

D - I DON'T KNOW.

(Pause.)

QUESTION 11: IF YOU TOOK ALL OF THE TRIANGLES AND THE RECTANGLES ABOVE AND PUT THEM IN A GROUP THERE WOULD BE _____ THERE WERE POLYGONS.

A - FEWER OF THEM THAN

B - MORE OF THEM THAN

C - THE SAME AMOUNT OF THEM AS

OR

D - I DON'T KNOW.

(Pause.) TURN TO PAGE 14.

PROBLEM 12a: BELOW ARE FOUR DRAWINGS. PUT AN X ON THE ONE THAT IS DIFFERENT FROM THE OTHER THREE.

PROBLEM 12b: BELOW ARE FOUR DRAWINGS. PUT AN X ON THE ONE THAT IS DIFFERENT FROM THE OTHER THREE.

PROBLEM 12c: BELOW ARE FOUR DRAWINGS. PUT AN X ON THE ONE THAT IS DIFFERENT FROM THE OTHER THREE.

THIS IS THE LAST PROBLEM IN THIS BOOKLET. (Collect answer booklets.)

Directions for Booklet IC

(For Kindergarten complete the requested Name Information. Direct older students to complete the Name Information.)

****

Primary Instructions

OPEN YOUR BOOKLET TO PAGE 1. IN THIS SECTION YOU ARE TO SOLVE PROBLEMS ABOUT THE DRAWINGS THAT ARE GIVEN. WE WILL DO EACH QUESTION AS WE DID BEFORE. I WILL READ EACH QUESTION AND THE DIFFERENT ANSWERS. YOU ARE TO MARK AN X ON THE LETTER OF THE ANSWER CHOICE THAT YOU THINK IS RIGHT. YOU MAY READ ALONG SILENTLY AS I READ OUT LOUD. READY?

(Using your test booklet, read each question and its answer choices twice. Pace students through the questions. Wait until all students have completed an item before proceeding to the next item.

****

Intermediate Instructions

WRITE YOUR NAME IN THE SPACE AT THE TOP OF THE FRONT PAGE. (Pause.) TURN TO PAGE 1. (Pause.) IN THIS SECTION YOU ARE TO SOLVE PROBLEMS ABOUT THE DRAWINGS THAT ARE GIVEN. FOR EACH QUESTION, YOU ARE TO SELECT THE CORRECT ANSWER FROM THOSE GIVEN. MARK AN "X" ON THE LETTER THAT IDENTIFIES THE CORRECT ANSWER. IF YOU DON'T KNOW THE CORRECT ANSWER, MARK AN "X" ON THE LETTER BY "I DON'T KNOW."

(In this section read aloud each question and the answer choices. Pace the students through the items. Wait until the students have completed an item before proceeding to the next item. Make sure all the students are on the right page.)

****

PROBLEM 1: ANGLES X, Y, AND Z HAVE EXACTLY THE SAME NUMBER OF DEGREES. SUPPOSE THAT SIDE y IS 2 INCHES LONG. HOW LONG IS SIDE x?

A. 1 INCH

B. 2 INCHES

C. 3 INCHES

D. IT IS IMPOSSIBLE TO TELL WITHOUT MEASURING.

OR

E. I DON'T KNOW.

(Pause.)

PROBLEM 2: SUPPOSE THAT ONE SIDE OF THIS EQUILATERAL TRIANGLE IS 2 INCHES LONG. THE PERIMETER OF THE TRIANGLE WOULD BE:

A. 12 INCHES

B. 6 INCHES

C. 3 INCHES

D. IT IS IMPOSSIBLE TO TELL WITHOUT MEASURING.

OR

E. I DON'T KNOW.

(Pause.)

PROBLEM 3a: LINE v BISECTS THE UPPER ANGLE OF THIS EQUILATERAL TRIANGLE. SUPPOSE THAT SIDE z IS 2 INCHES LONG. HOW MANY DEGREES ARE IN ANGLE Y?

A. 30°

B. 60°

C. 90°

D. IT IS IMPOSSIBLE TO TELL WITHOUT MEASURING.

OR

E. I DON'T KNOW.

(Pause.)

PROBLEM 3b: LINE v BISECTS THE UPPER ANGLE OF THIS EQUILATERAL TRIANGLE. SUPPOSE THAT SIDE z IS 2 INCHES LONG. LINE W WOULD THEN BE:

A - 1 INCH

B - 2 INCHES

C - 3 INCHES

D - IT IS IMPOSSIBLE TO TELL WITHOUT MEASURING.

OR

E - I DON'T KNOW.

(Pause.)

PROBLEM 4: SIDES u, v, AND w ARE OF EQUAL LENGTH. HOW MANY DEGREES ARE ANGLE V?

A. 60°

B. 90°

C. 120°

D. IT IS IMPOSSIBLE TO TELL WITHOUT MEASURING.

OR

E. I DON'T KNOW.

(Pause.)

PROBLEM 5: ONE SIDE OF THIS EQUILATERAL TRIANGLE IS 2 INCHES LONG. SUPPOSE THAT THERE WAS A SECOND TRIANGLE THAT WAS SIMILAR TO THIS ONE. HOW LONG WOULD ONE SIDE OF THE SIMILAR TRIANGLE BE?

A. 1 INCH

B. 2 INCHES

C. 3 INCHES

D. IT IS IMPOSSIBLE TO TELL WITHOUT MEASURING.

OR

E. I DON'T KNOW.

(Pause.)

PROBLEM 6: SIDES u, v, AND y ARE OF EQUAL LENGTH. THEREFORE, ANGLE W IS _____ ANGLE V.

A. LARGER THAN

B. SMALLER THAN

C. EQUAL TO

D. IT IS IMPOSSIBLE TO TELL WITHOUT MEASURING.

OR

E. I DON'T KNOW.

(Pause.)

PROBLEM 7: ANGLES X, Y, AND Z EACH HAVE EXACTLY THE SAME NUMBER OF DEGREES. THEREFORE, SIDE x IS _____ SIDE y.

A. LONGER THAN

B. SHORTER THAN

C. EQUAL TO

D. IT IS IMPOSSIBLE TO TELL WITHOUT MEASURING.

OR

E. I DON'T KNOW.

(Pause.)

PROBLEM 8a: LINE p BISECTS THE UPPER ANGLE OF THIS EQUILATERAL TRIANGLE. ANGLE X IS _____ ANGLE Y.

A - LARGER THAN

B - SHORTER THAN

C - EQUAL TO

D - IT IS IMPOSSIBLE TO TELL WITHOUT MEASURING.

OR

E - I DON'T KNOW.

(Pause.)

PROBLEM 8b: LINE p BISECTS THE UPPER ANGLE OF THIS EQUILATERAL TRIANGLE; THEREFORE, LINE m IS _____ LINE n.

A. LONGER THAN

B. SHORTER THAN

C. EQUAL TO

D. IT IS IMPOSSIBLE TO TELL WITHOUT MEASURING.

OR

E. I DON'T KNOW.

(Pause.)

PROBLEM 9: THIS IS AN EQUILATERAL TRIANGLE. SUPPOSE THAT THE TRIANGLE WAS MADE LARGER BY INCREASING THE LENGTH OF EACH SIDE BY 1 INCH. THE SHAPE OF THE NEW TRIANGLE WOULD BE _____ THE DRAWING ON THE LEFT.

A. SIMILAR TO

B. DIFFERENT FROM

C. ALMOST THE SAME AS

OR

D. I DON'T KNOW.

(Pause.)

PROBLEM 10: THIS IS AN EQUILATERAL TRIANGLE WITH SIDES x, y, AND z. ITS PERIMETER IS _____.

A. THREE TIMES THE LENGTH OF SIDE x, OR y, OR z.

B. THREE TIMES THE LENGTH OF THE SUM OF THE SIDES x, y, and z.

C. TWO TIMES THE LENGTH OF SIDES x, OR y, OR z.

CR

D. I DON'T KNOW.

(Pause.)

PROBLEM 11: COMPLETE THE FOLLOWING SENTENCE: "IF THE THREE SIDES OF A TRIANGLE ARE OF EQUAL LENGTH, _____."

A. THE ANGLES OF THE TRIANGLE ARE NOT EQUAL IN THE NUMBER OF DEGREES.

B. ONE ANGLE OF THE TRIANGLE IS SMALLER THAN THE OTHER TWO ANGLES.

C. THE ANGLES OF THE TRIANGLE ARE EQUAL IN THE NUMBER OF DEGREES.

D. ONE ANGLE OF THE TRIANGLE IS LARGER THAN THE OTHER TWO ANGLES.

OR

E. I DON'T KNOW.

(Pause.)

PROBLEM 12: COMPLETE THE FOLLOWING SENTENCE: "IF THE ANGLES OF A TRIANGLE ARE EQUAL IN THE NUMBER OF DEGREES, _____."

A. ONE SIDE OF THE TRIANGLE IS LONGER THAN THE OTHER TWO SIDES."

B. ONE SIDE OF THE TRIANGLE IS SHORTER THAN THE OTHER TWO SIDES."

C. THE SIDES OF THE TRIANGLE ARE NOT EQUAL IN LENGTH."

D. THE SIDES OF THE TRIANGLE ARE OF EQUAL LENGTH."

OR

E. I DON'T KNOW.

(Pause.)

PROBLEM 13: COMPLETE THE FOLLOWING SENTENCE: "THE PERIMETER OF AN EQUILATERAL TRIANGLE IS _____ THE LENGTH OF ANY SIDE."

A. TWO TIMES

B. THREE TIMES

C. FOUR TIMES

OR

D. I DON'T KNOW.

(Pause.)

PROBLEM 14: COMPLETE THE FOLLOWING SENTENCE: " A LINE THAT BISECTS ANY ANGLE OF AN EQUILATERAL TRIANGLE FORMS TWO _____ WHEN IT INTERSECTS THE OPPOSITE SIDE."

A. UNEQUAL ANGLES

B. EQUAL ANGLES

C. UNEQUAL LINES

D. EQUAL LINES

OR

E. I DON'T KNOW.

(Pause.)

PROBLEM 15: COMPLETE THE FOLLOWING SENTENCE: "ALL EQUILATERAL TRIANGLES ARE:

A. NOT IDENTICAL

B. CONGRUENT

C. SIMILAR

D. THE SAME

OR

E. I DON'T KNOW.

(Pause.)

THIS IS THE LAST PROBLEM IN THIS BOOKLET. (Collect test booklets.)

Directions for Booklet ID

****

(For Kindergarten complete the requested Name Information. Direct older students to complete the Name Information.)

****

Primary Instructions

OPEN YOUR BOOKLET TO PAGE 1. IN THIS SECTION YOU ARE TO TELL THE WORD OR PHRASE THAT BEST FITS THE DRAWING OR DRAWINGS THAT ARE TALKED ABOUT IN THE QUESTION. WE WILL DO EACH QUESTION AS WE DID BEFORE. READY?

(Using your test booklet read each question and its answer choices twice. KINDERGARTEN ONLY: When two groups of drawings are shown for a question, point to the group as you read it in the question; point to each answer choice as you read it aloud.)

****

Intermediate Instructions

WRITE YOUR NAME AT THE TOP OF THE PAGE. (Pause.) TURN TO PAGE 1. (Pause.) IN THIS SECTION, YOU ARE TO IDENTIFY THE WORD OR PHRASE THAT BEST FITS THE DRAWING OR DRAWINGS INDICATED. MARK AN "X" ON THE LETTER THAT IDENTIFIES THE CORRECT ANSWER. IF YOU DON'T KNOW THE CORRECT ANSWER, MARK AN "X" ON THE LETTER BY "I DON'T KNOW."

(In this section read aloud each question and the answer choices. Pace the students through the items. Wait until the students have completed an item before proceeding to the next item. Make sure all the students are on the right page.)

****

PROBLEM 1: SUPPOSE THAT SIDES X AND Y ARE EACH 3 INCHES LONG. CHOOSE THE ONE ANSWER WHICH BEST DESCRIBES HOW SIDE X IS LIKE SIDE Y. SIDE X AND Y _____.

A. ARE OF EVEN LENGTH.

B. ARE OF EQUAL LENGTH.

C. COINCIDE IN LENGTH.

OR

D. I DON'T KNOW.

(Pause.)

PROBLEM 2: WHICH ONE NAME BEST FITS ALL OF THE DRAWINGS IN GROUP 1 BUT DOES NOT FIT ALL OF THE DRAWINGS IN GROUP 2?

A. SQUARES

B. TRAPEZOIDS

C. TRIANGLES

D. RECTANGLES

OR

E. I DON'T KNOW.

(Pause.)

PROBLEM 3: WHAT IS THE ONE WORD THAT BEST INDICATES WHAT THE ARROW IS POINTING AT?

A. ANGLE

B. LINE

C. SIDE

D. BASE

OR

E. I DON'T KNOW.

(Pause.)

PROBLEM 4: WHICH ONE NAME BEST FITS ALL OF THE DRAWINGS IN GROUP 1 BUT DOES NOT FIT ALL OF THE DRAWINGS IN GROUP 2?

A. SYMMETRICAL FIGURES

B. CLOSED FIGURES

C. REGULAR FIGURES

OR

D. I DON'T KNOW.

(Pause.)

PROBLEM 5: WHAT IS THE ONE WORD THAT BEST INDICATES WHAT EACH ARROW IS POINTING TO?

A. ANGLE

B. VERTEX

C. SIDE

D. STRAIGHT EDGE

OR

E. I DON'T KNOW.

(Pause.)

PROBLEM 6: WHICH ONE NAME BEST FITS ALL OF THE DRAWINGS IN GROUP 1 BUT DOES NOT FIT ALL OF THE DRAWINGS IN GROUP 2?

A. SCALENE TRIANGLES

B. RIGHT TRIANGLES

C. OBTUSE TRIANGLES

D. EQUILATERAL TRIANGLES

OR

E. I DON'T KNOW.

(Pause.)

PROBLEM 7: WHICH ONE NAME BEST FITS ALL OF THE DRAWINGS IN GROUP 1 BUT DOES NOT FIT ALL OF THE DRAWINGS IN GROUP 2?

A. SYMMETRICAL FIGURES

B. SIMPLE FIGURES

C. REGULAR FIGURES

OR

D. I DON'T KNOW.

(Pause.)

(Collect all the booklets and the pencils.)

V

TEST BATTERY

NOTE: On the following pages B, R, and Y refer to the color of the shape: B = Blue, R = Red, and Y = Yellow.

Name _____ Birthdate _____
Last First Middle Month Day Year

School _____ Grade _____ Today's Date _____

Sex F M

Conceptual Learning and Development Assessment Series I (A)

Klausmeier, H.J., Ingison, L.J., Sipple, T.S., and Katzenmeyer, C.G.

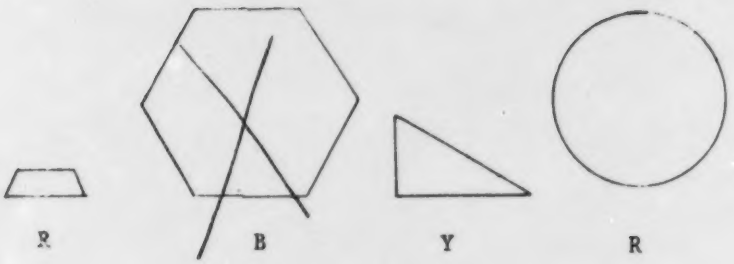
DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.

A.

B

Stop

A.



R B Y R

Stop

B.

R

Stop

B.

R Y R B

1.a

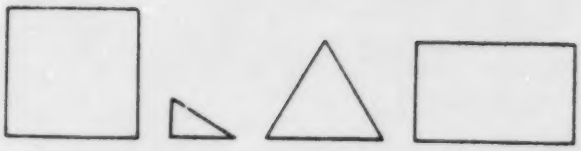
9

Y

Stop

1.b

10



B R Y R

Stop

2.a

11

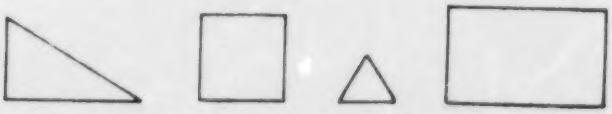
R

Stop

2.b

12

B Y B



Y B R Y

Stop

44

3.a

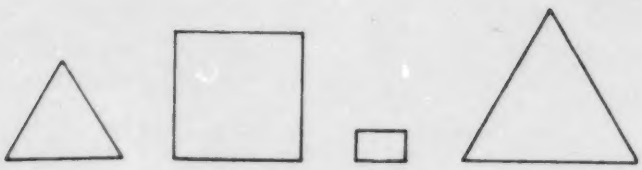
13

R

Stop

3.b

14



B B R R

Stop

4.a

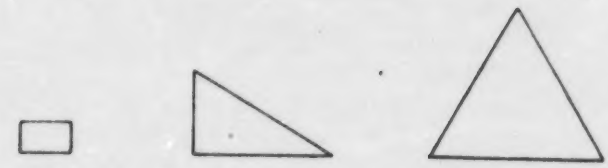
15

B

Stop

4.b

16



B R Y

B R B R

Stop

5.a

45

17

Y

Stop

5.b

18

Y Y B Y

Stop

6.a

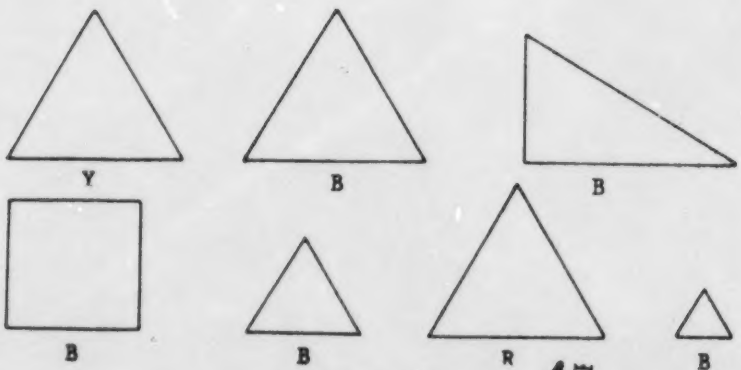
19

B

Stop

6.b

20



Y B B

B B R B

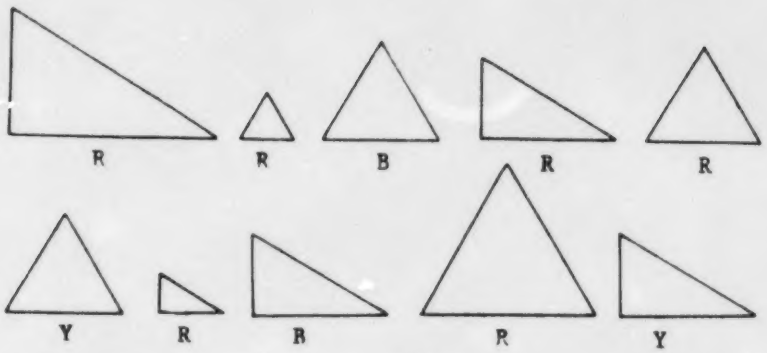
Stop

46

7.a

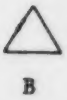
Stop

7.b



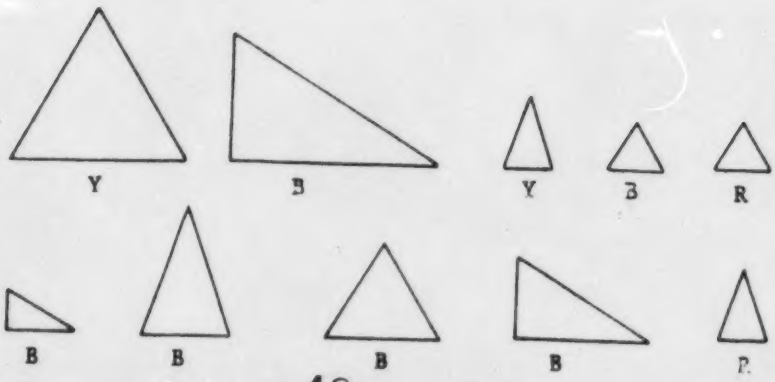
Stop

8.a



Stop

8.b



Stop

9.a

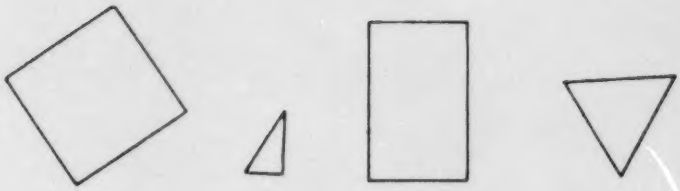
47 25

Y

Stop

9.b

26



B R R Y

Stop

10.a

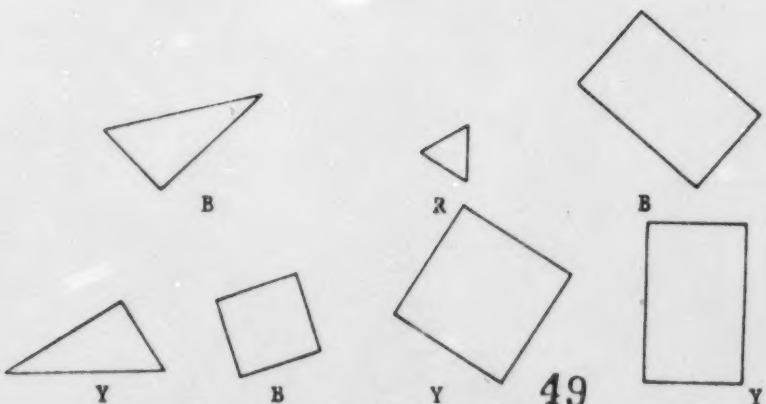
27

R

Stop

10.b

28



B R B Y B Y Y

Stop

11.a

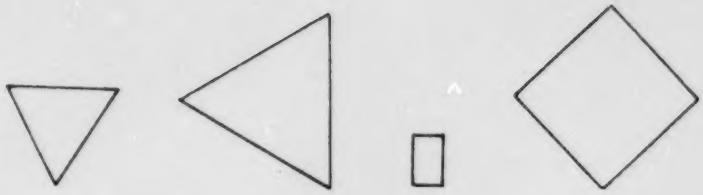
29

R

Stop

11.b

30



B R R B

Stop

12.a

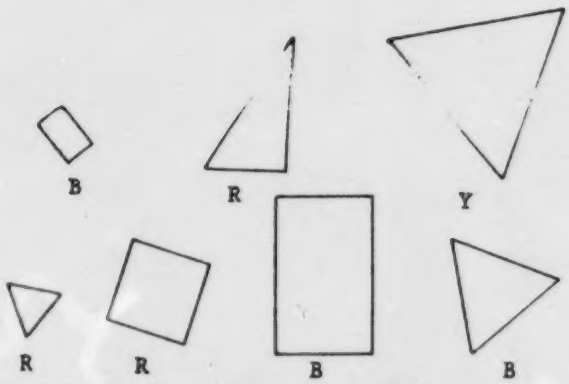
31

B

Stop

12.b

32



B R Y

R R B B

Stop

13.a

49

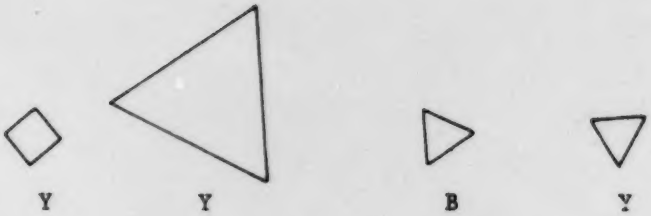
33

Y

Stop

13.b

34



Y Y B Y

Stop

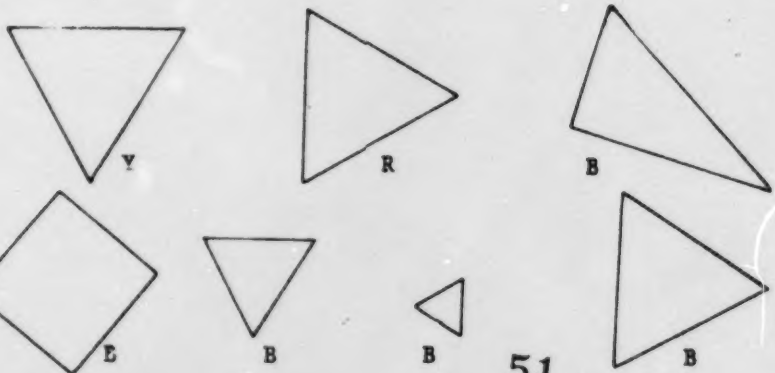
14.a

35

B

Stop

14.b



Y R B E B B B

Stop

15.a

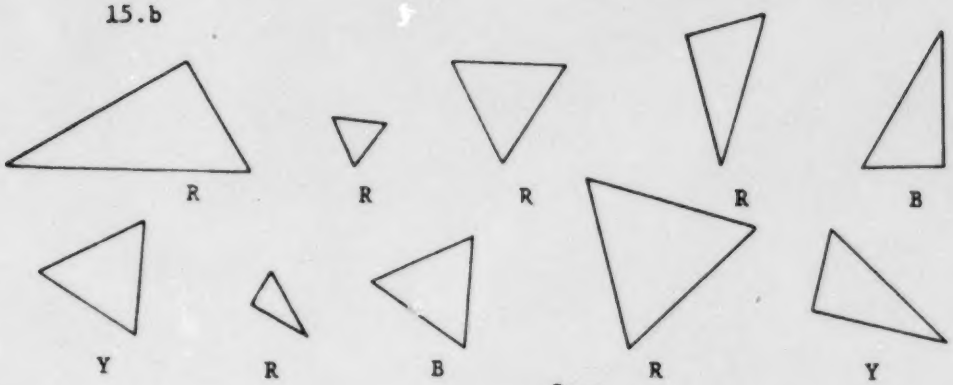
37

R

Stop

15.b

38



Stop

16.a

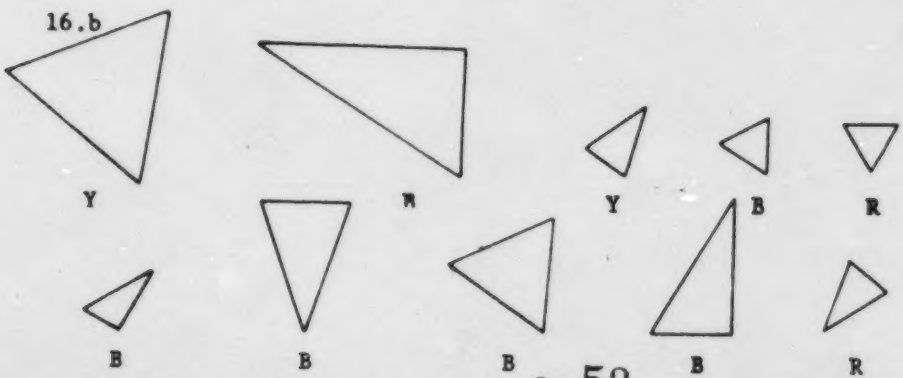
39

B

Stop

16.b

40



Stop

Name _____

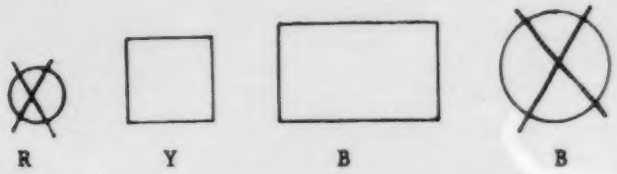
Conceptual Learning and Development Assessment Series I (B)

Klausmeier, H.J., Ingison, L.J., Sipple, T.S., and Katzenmeyer, C.G.

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.

1

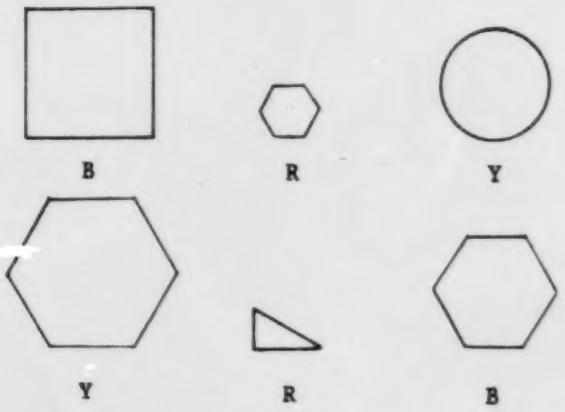
A. Put an X on the drawings on the right that have exactly the same shape as the one on the left.



Stop

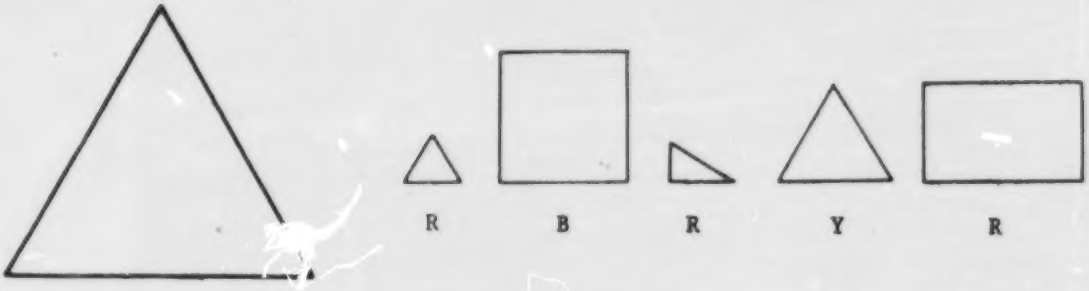
2

B. Put an X on the drawings on the right that have exactly the same shape as the one on the left. You can look back at the drawing on the left if you are not sure.



Stop

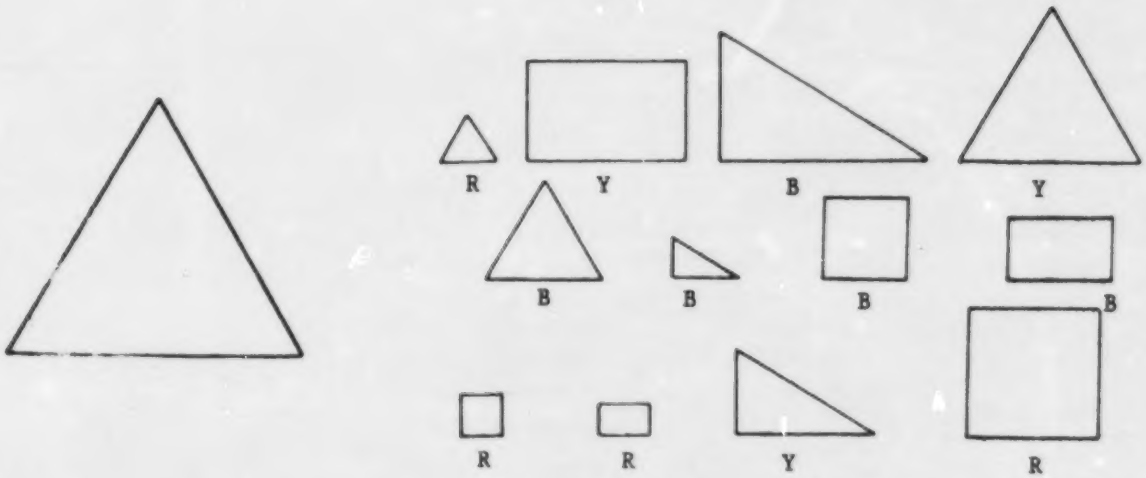
1. Put an X on the drawings on the right that have exactly the same shape as the one on the left.



Stop

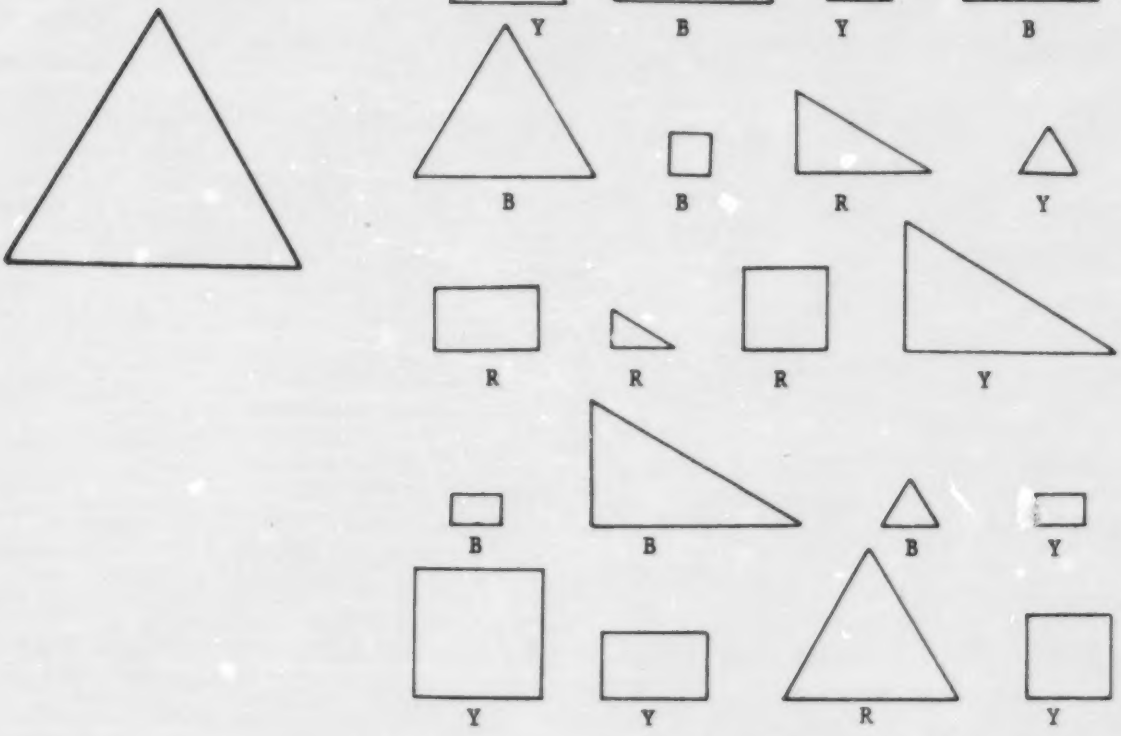
4

2. Put an X on the drawings on the right that have exactly the same shape as the one on the left.



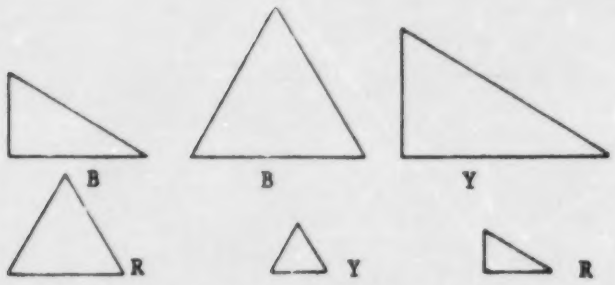
Stop

3. Put an X on the drawings on the right that have exactly the same shape as the one on the left.



Stop

6



4. Are all of the three-sided figures above equilateral triangles?

a. Yes, all of them are equilateral triangles

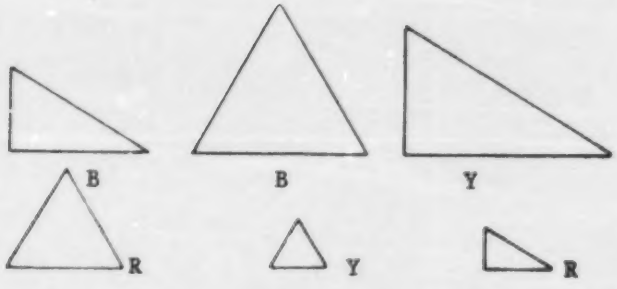
b. No, some of them are not equilateral triangles.

c. No, none of them are equilateral triangles.

d. I don't know.

Stop

7



5. Are all of the equilateral triangles above triangles?

a. No, only some of them are triangles.

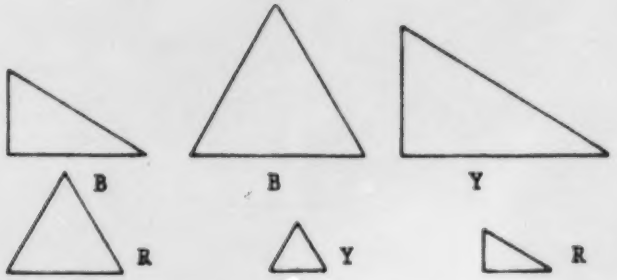
b. No, none of them are triangles.

c. Yes, all of them are triangles.

d. I don't know.

Stop

8



6. If you took all of the equilateral triangles and the right triangles above and put them in a group there would be _____ there were three-sided figures.

a. fewer of them than

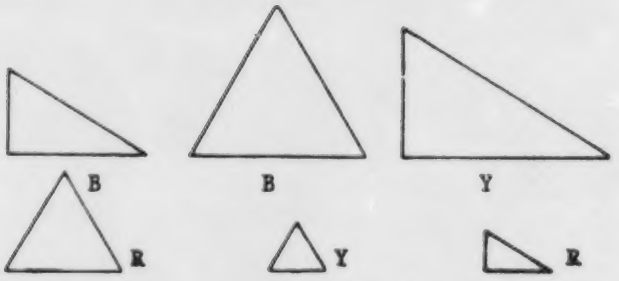
b. more of them than

c. the same amount of them as

d. I don't know.

Stop

9



7. Are all of the red figures above equilateral triangles?

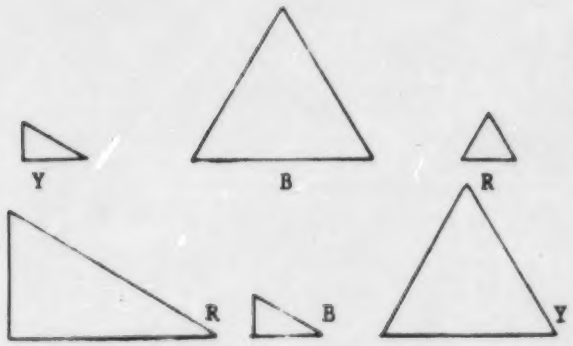
a. No, some of them are not equilateral triangles.

b. Yes, all of them are equilateral triangles.

c. No, none of them are equilateral triangles.

d. I don't know.

Stop



8. Are all of the small figures above equilateral triangles?

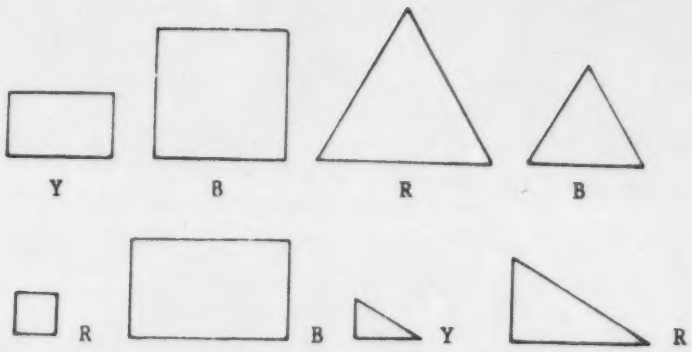
   a. No, some of them are not equilateral triangles.

   b. Yes, all of them are equilateral triangles.

   c. No, none of them are equilateral triangles.

   d. I don't know.

Stop



9. Are all of the triangles above polygons?

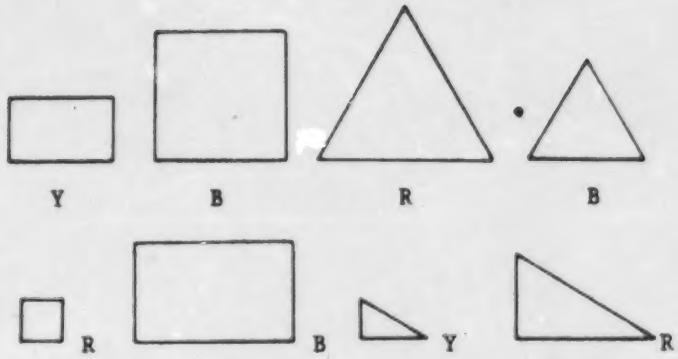
   a. No, none of them are polygons.

   b. Yes, all of them are polygons.

   c. No, only some of them are polygons.

   d. I don't know.

Stop



10. Are all of the polygons above triangles?

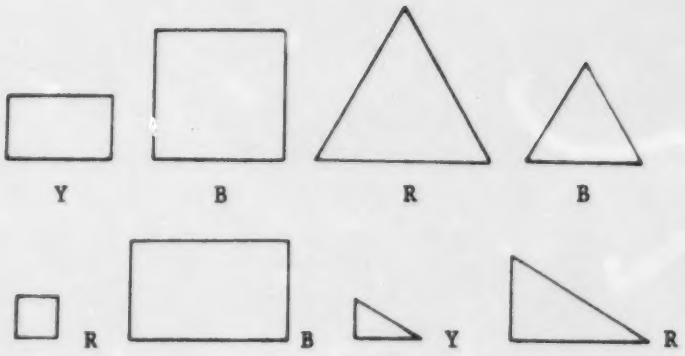
a. No, some of them are not triangles.

b. Yes, all of them are triangles.

c. No, none of them are triangles.

d. I don't know.

Stop



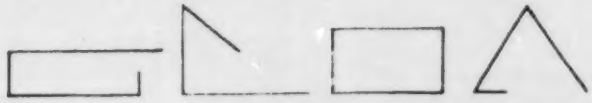
11. If you took all of the triangles and the rectangles above and put them in a group there would be _____ there were polygons.

a. fewer of them than
b. more of them than
c. the same amount of them as
d. I don't know

Stop

14

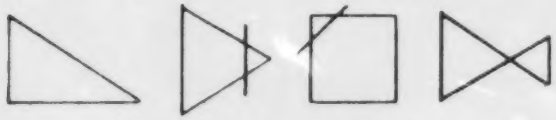
12.a Below are four drawings. Put an X on the one that is different from the other three.



Stop

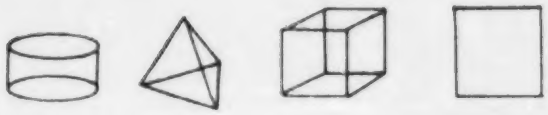
15

12.b Below are four drawings. Put an X on the one that is different from the other three.



Stop

12.c Below are four drawings. Put an X on the one that is different from the other three.



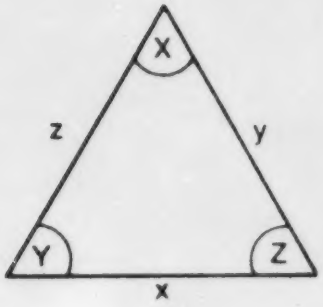
Stop

Name _____

Conceptual Learning and Development Assessment Series I (C)

Klausmeier, H.J., Irgison, L.J., Sipple, T.S., and Katzenmeyer, C.G.

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.



Angles X, Y, and Z have exactly the same number of degrees. Suppose that side y is 2 inches long. How long is side x?

a. 1 inch

b. 2 inches

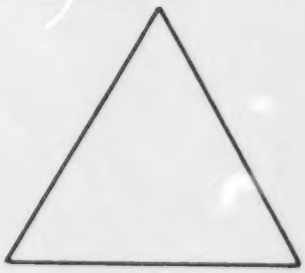
c. 3 inches

d. It is impossible to tell without measuring.

e. I don't know.

Stop

2



Suppose that one side of this equilateral triangle is 2 inches long. The perimeter of the triangle would be _____.

a. 12 inches

b. 6 inches

c. 3 inches

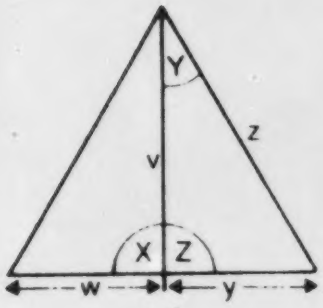
d. It is impossible to tell without measuring.

e. I don't know.

64

Stop

3A



Line v bisects the upper angle of this equilateral triangle. Suppose that side z is 2 inches long. How many degrees are in angle Y?

a. 30°

b. 60°

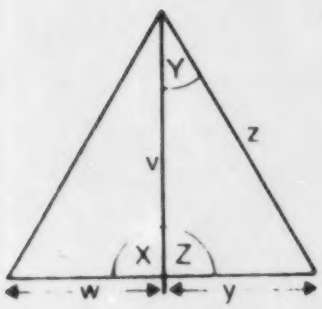
c. 90°

d. It is impossible to tell without measuring.

e. I don't know.

Stop

3B



Line v bisects the upper angle of this equilateral triangle. Suppose that side z is 2 inches long. Line w would then be:

a. 1 inch

b. 2 inches

c. 3 inches

d. It is impossible to tell without measuring.

e. I don't know.

Stop

Sides u, v and w are of equal length. How many degrees are in angle V?

a. 60°

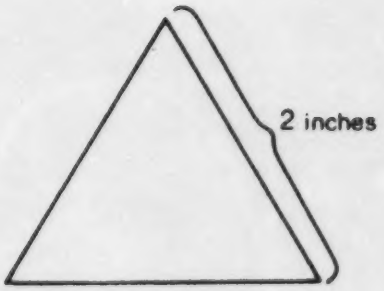
b. 90°

c. 120°

d. It is impossible to tell without measuring.

e. I don't know.

Stop



One side of this equilateral triangle is 2 inches long. Suppose that there was a second triangle that was similar to this one. How long would one side of the similar triangle be?

a. 1 inch

b. 2 inches

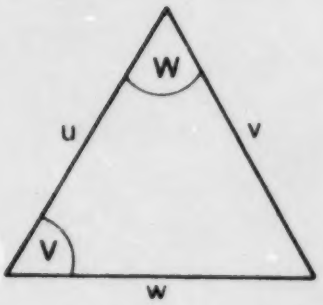
c. 3 inches

d. It is impossible to tell without measuring.

e. I don't know.

Stop

6



Sides u, v, and w are of equal length. Therefore, angle W is_____ angle V.

a. larger than

b. smaller than

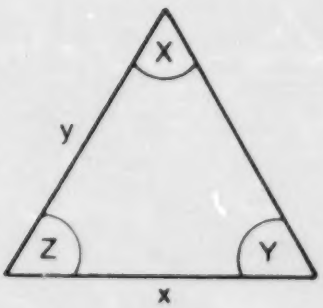
c. equal to

d. It is impossible to tell without measuring.

e. I don't know.

Stop

7



Angles X, Y, and Z each have exactly the same number of degrees. Therefore, side x is_____side y.

a. longer than

b. shorter than

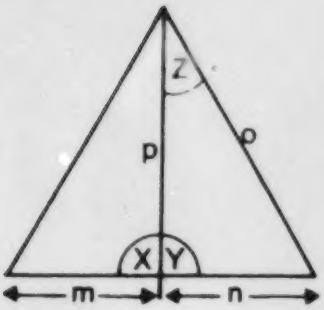
c. equal to

d. It is impossible to tell without measuring.

e. I don't know.

Stop

8A



Line p bisects the upper angle of this equilateral triangle. Angle X is _____ angle Y.

a. larger than

b. shorter than

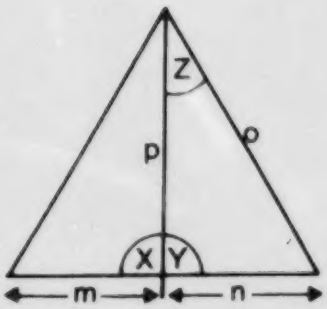
c. equal to

d. It is impossible to tell without measuring.

e. I don't know.

Stop

8



Line p bisects the upper angle of this equilateral triangle; therefore, line m is _____ line n.

a. longer than

b. shorter than

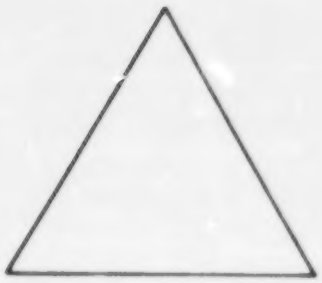
c. equal to

d. It is impossible to tell without measuring.

e. I don't know.

Stop

9



This is an equilateral triangle. Suppose that the triangle was made larger by increasing the length of each side by 1 inch. The shape of the new triangle would be _____ the drawing on the left.

a. similar to

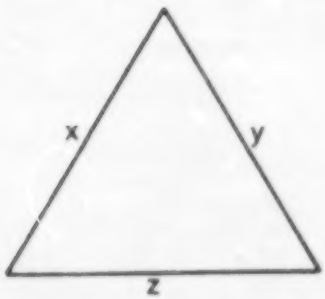
b. different from

c. almost the same as

d. I don't know.

Stop

10



This is an equilateral triangle with sides x, y, and z. Its perimeter is _____.

a. three times the length of side x, or y, or z.

b. three times the length of the sum of sides x, y, or z.

c. two times the length of sides x, or y, or z.

d. I don't know.

Stop 69

11

Complete the following sentence: "If the three sides of a triangle are of equal length, _____."

a. the angles of the triangle are not equal in the number of degrees

b. one angle of the triangle is smaller than the other two angles

c. the angles of the triangle are equal in the number of degrees

d. one angle of the triangle is larger than the other two angles

e. I don't know.

Stop

12

Complete the following sentence: "If the angles of a triangle are equal in the number of degrees, _____."

a. one side of the triangle is longer than the other two sides

b. one side of the triangle is shorter than the other two sides

c. the sides of the triangle are not equal in length

d. the sides of the triangle are of equal length

e. I don't know.

Stop

Complete the following sentence: "The perimeter of an equilateral triangle is_____the length of any side."

a. two times

b. three times

c. four times

d. I don't know.

Stop

Complete the following sentence: "A line that bisects any angle of an equilateral triangle forms two _____ when it intersects the opposite side."

a. unequal angles

b. equal angles

c. unequal lines

d. equal lines

e. I don't know.

Stop

Complete the following sentence: "All equilateral triangles are_____."

a. not identical

b. congruent

c. similar

d. the same

e. I don't know.

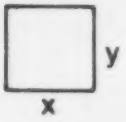
Stop

Name _____

Conceptual Learning and Development Assessment Series I (D)

Klausmeier, H.J., Ingison, L.J., Sipple, T.S., and Katzenmeyer, C.G.

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.



Suppose that sides x and y are each 3 inches long. Choose the one answer which best describes how side x is like side y. Side x and side y _____.

a. are of even length.

b. are of equal length.

c. coincide in length.

d. I don't know.

Stop

Group 1

Group 2

Which one name best fits all of the drawings in Group 1 but does not fit all of the drawings in Group 2?

a. squares

b. trapezoids

c. triangles

d. rectangles

e. I don't know.

74

Stop

3

What is the one word that best indicates what the arrow is pointing at?

a. angle

b. line

c. side

d. base

e. I don't know.

Stop

4

Group 1

Group 2

Which one name best fits all of the drawings in Group 1 but does not fit all of the drawings in Group 2?

a. symmetrical figures

b. closed figures

c. regular figures

d. I don't know.

Stop

What is the one word that best indicates what each arrow is pointing to?

a. angle

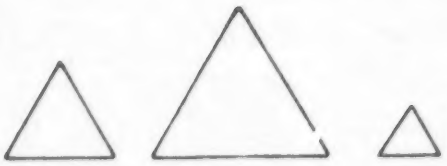
b. vertex

c. side

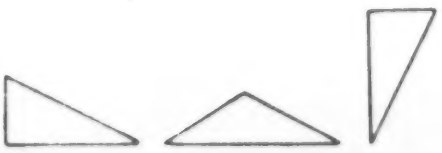
d. straight edge

e. I don't know.

Stop



Group 1



Group 2

Which one name best fits all of the drawings in Group 1 but does not fit all of the drawings in Group 2?

a. scalene triangles

b. right triangles

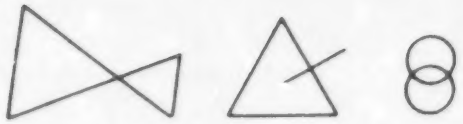
c. obtuse triangles

d. equilateral triangles

e. I don't know.

Stop

Group 1



Group 2

Which one name best fits all of the drawings in Group 1 but does not fit all of the drawings in Group 2?

a. symmetrical figures

b. simple figures

c. regular figures

d. I don't know.

Stop

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977